

BACKGROUND

SUBJECT: ROBOTICS AND INTELLIGENT MACHINES (RIM) INITIATIVE **DOE FUNDING LEVELS: FY99: \$12.392M FY00: \$13.953M FY01: \$19.807M**

What it is: The DOE is faced with a complex and diverse array of demands resulting from its missions. It must ensure the safety and reliability of the enduring nuclear stockpile, protect the safety of its employees, and clean up and protect the environment at highly complex and contaminated sites. One of the most promising solutions to these demands lies in the widespread introduction and use of robotics and intelligent machines (RIM). In the 1990's DOE launched a prototype of the RIM Initiative that developed a needs-based, focused, science and technology foundation for RIM, and then deployed this emerging RIM S&T into cost-effective systems operating at the DOE's plants and sites. This approach, with its emphasis on needs-based research and subsequent continuity and integration from *research* to *development* to *application* and *deployment*, proved to be successful. The RIM Initiative, which integrates activities within the Offices of Defense Programs, Environmental Management, Materials Disposition and Science accelerates the deployment of the approach.

Areas of Research at DOE: The science and technology that DOE will develop will allow robots to work cost-effectively and productively in "*small lot*" and "*unstructured*" environments. While industrial robots have operated cost-effectively for more than a decade in mass production situations, they have had difficulty penetrating manufacturing operations in which only a limited number of products are built—the typical situation in many of DOE's manufacturing operations. This is because using today's technology, not enough products are built over which to amortize the cost of setting up robot workcells. However, the vast power of computing now available within the DOE permits the creation of robot workcells at much lower costs and with much more adaptable abilities. Furthermore, a very valuable outcome of the DOE's RIM planning activities was the understanding that the technology base needed for DOE's small lot manufacturing is very similar to that needed for DOE's highly unstructured working environments such as the remediation of contaminated waste sites. This understanding is the basis of the cooperation among the DOE Offices mentioned earlier.

Past Accomplishments:

- The work of DOE's scientists in the 1990s resulted in the deployment of a number of systems across DOE's complex of plants and sites. Deployments at the Pantex plant in Texas and the Oak Ridge National Laboratory each allowed the DOE to avoid costs of more than \$100M, while at the same time removing workers from hazardous operations.
- DOE's RIM scientists have been awarded eight R&D 100 awards, more than 40 patents on their work and most recently have received three Millenium Medals from the International Society of Electrical and Electronics Engineers, more than any other institution.
- The work of DOE's RIM scientists is sought by other Federal agencies. For example, using technologies developed by the DOE for its production operations, the Air Force developed a system for re-coating the F-117 Stealth fighter in order to reduce costs and remove workers from hazards. This work resulted in other improvements.

Future Research: The RIM Roadmap identified the science and technology needed to:

- Reduce personnel exposure to hazards by 50% by 2002,
- Reduce the time and cost for refurbishment of appropriate stockpile hardware by 20% by 2004,
- Reduce the occurrence of manufacturing defects in refurbished stockpile hardware to 50% of current levels by 2004, and
- Reduce the exposure of personnel to hazards by 80% while simultaneously reducing turnaround time.